department chair, dean, and university president should be presented with a copy of these recommendations.

Because of its brevity, the book reads almost like a set of *Cliff's Notes* in places. While much of this advice is basic because it's all located in one place, *Advisor, Teacher, Role Model, Friend* defines a holistic model for mentoring that is far richer than that adopted by most academic departments. Most faculty, for example, understand their role as academic and scientific mentors, but many feel ill-equipped to give their students practical career advice, especially for careers outside of research science.

This book supplies, along with encouragement, some useful references that mentors can explore and steer their students to. By adopting brevity over depth, *Advisor, Teacher, Role Model, Friend* may reach those many busy scientists who don't have time for more personal accounts of the mentorship process in science, such as Robert Kanigel's *Apprenticeship to Genius* or Peter Medawar's *Advice to a Young Scientist.*

Brevity, however, has its drawbacks. While the case studies are intended to illustrate some basic concepts about cultural or personal sensitivity, they are simply too short to capture the complexities of real student-mentor situations. The book also has a few profiles of scientists who are now pursuing alternative careers, but these are copied wholesale from the *NAS Career Guide.* With the breadth of exciting and diverse careers that scientists are pursuing, it seems a missed opportunity not to profile four or five new people rather than repeating previously published information.

While this book is intended for mentors, the lack of any significant discussion about the role and obligation of students leaves one with the impression that mentorship is a one-way process, from mentor to student. Students and young scientists must understand that they, not their advisors and mentors, are primarily responsible for their career development. Students must be proactive, seeking out mentors not only in their academic or scientific disciplines but in every part of their lives. Mentoring is a relationship requiring hard work and time, like any other.

Advisor, Teacher, Role Model, Friend is an important contribution to higher education, and students and their mentors will benefit enormously if its recommendations are adopted. It is short, useful, and freely accessible on the Web. The advice it contains, and the dialog it stimulates, may do much to improve our system of graduate education in the sciences.—*Peter S. Fiske, Lawrence Livermore National Laboratory, Livermore, Calif.*

Acknowledgement

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About AGU

Helmberger Receives Lehmann Medal

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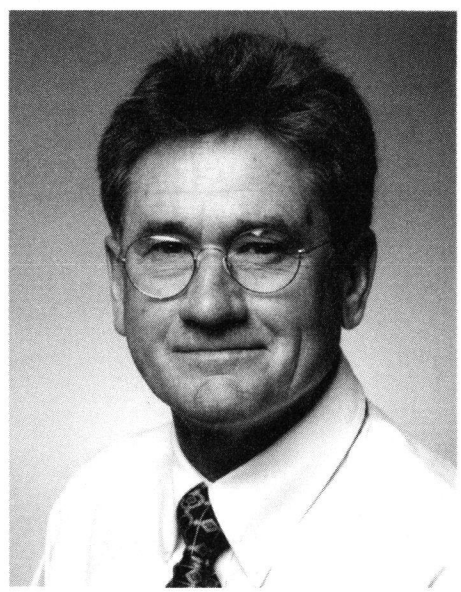
Don Helmberger was awarded the Inge Lehmann Medal at the AGU Fall Meeting Honors Ceremony, which was held on December 10, 1997, in San Francisco, California. The Lehmann Medal is given in recognition of outstanding contributions to the understanding of the structure, composition, and dynamics of the Earth's mantle and core. The citation and response are given here.

Citation

"One century ago, on June 12, 1897, the great Assam earthquake occurred. It was thoroughly investigated by R. D. Oldham, who was the head of the Geological Survey of India. Oldham used recordings of the earthquake to identify clearly for the first time the *S* wave and to prepare the first travel time tables for *P* waves and *S* waves. Thus began the use of seismological data to infer the internal structure of the Earth. Subsequently, in 1906, Oldham deduced the existence of the fluid core. Gutenberg published his determination of its radius in 1915 and Lehmann discovered the inner core in 1935. Her discovery is the primary basis for the establishment of the award in her name.



"In the late twentieth century it was discovered that the inner core is solid, that it is anisotropic, and that it has a dissipative zone just beneath the inner core boundary. Furthermore, it seems to rotate slightly faster than the rest of the Earth. For the outer core and the base of the mantle it has been discovered that there are patches of very low shear modulus just above the outer core boundary and that the outer core is very nearly a perfect fluid. The cores of the Earth play the major role in the generation of the Earth's magnetic field and contribute prominently to variations in the length of day. The study of the Earth's cores has become a major branch of geophysics, the seismological components of the study being dominated by Don Helmberger and his students and postdoctoral fellows. His contributions are manifold, quantitative, and durable. For all that he has accomplished he has been chosen to be the first recipient of the Inge Lehmann Medal of the American Geophysical Union.

"It is usually considered to be bad luck to be a younger member of a large family. One's older siblings tend to smother one's individuality. There are exceptions, though. One was Benjamin Franklin, who was preceded by 14 brothers and sisters. Another is Don Helmberger, the youngest of a baker's dozen. Don grew up in a Catholic family in Minnesota and received his undergraduate education there.

"As a Ph.D. student at the Scripps Institution of Oceanography, Don was supervised by Russell Raitt and me. Don's performance was a pleasure to us. He used the excellent marine seismic data collected by Russ and carefully archived at Scripps and the method of generalized ray theory for computing synthetic seismograms to produce a Ph.D. thesis that, in retrospect, was considerably ahead of the times. Don, more than anyone else, pioneered quantitative seismology: the comparison of realistic, computed seismograms with observed data to infer deep Earth structure.

"Don's tenure at the California Institute of Technology has been marked by a sequence of major accomplishments, and he is being honored here for those that relate to the Earth's cores. Yet it is very important to em-

phasize that Don is a superb teacher and trainer of research students, as well. His graduates have populated the faculties of the best universities in the country and a handful of them have won the AGU Macelwane Medal. I know that Don is quietly proud of them, just as I am proud of him.

"If Don's bibliography were restricted only to his contributions to the structure of the Earth's cores, it would be a tribute to any geophysicist. Those of us who know Don are aware that there is much more than that restricted list. His work on the structure of the crust and upper mantle and his studies of earthquake source mechanisms, very important to the comprehensive test ban treaty, attest to the range of this gifted scientist. To tell more now would be to exceed the scope of this citation. So, we must await another occasion, another time, perhaps another award, to learn more about the career of Donald Vincent Helmberger, Inge Lehmann Medalist."—*J. Freeman Gilbert, University of California, San Diego*

Response

"Thank you, Freeman, for your generous remarks and to all of you who have earned this award for me. I am delighted to receive this medal on behalf of all of us wiggly line lovers.

"It is traditional for medalists to describe the particular case of circumstances and good luck leading to their careers. In my case, it is serendipity cubed, having been raised on the shores of Lake Wilbegon (about halfway between Fargo and Brainerd). Recently, I have discovered that Gary Glazmeier was born on the opposite shore, and he too must have observed the Northern Lights and other strange optical phenomenon associated with very cold climates. Perhaps, we both dreamed of studying such stuff, which leads one to think of a rotating core? Or maybe, just some other place that is warmer than Minnesota? I don't remember, except dreaming is what I do best.

"In the summer of 1960, a cruise to the North Pacific and the Bering Sea, called Leapfrog, provided my first big opportunity to see the Earth without snow on it. George Shor and his wife, Betty, also introduced me to Scripps hospitality at its finest, something totally different than the culture at a 30K university. He and Russ Raitt (a remarkable man) slipped me through the back door of University of California at San Diego as one of their first graduate students. Russ did his Ph.D. work under Millikan at the California Institute of Technology and approached marine geophysics quite differently than other people in the exploration business. He conducted research in the ocean as if it were a laboratory, no easy task as I quickly learned (100-knot winds, etc.). The pressure history of each shot was measured and logged, the recording system calibrated in absolute strengths, and all assembled nicely into operator form. After taking Freeman's course in theoretical seismology, it was easy to construct synthetics by simply performing convolutions, since they did all work.

"My next good fortune was meeting Frank Press, who offered me a postdoc at the Massachusetts Institute of Technology. There, Nafi Toksoz introduced me to real seismograms and deep Earth structure. Ralph Wiggins and I started modeling upper mantle triplications with this data, which seems to have set the course of my career.

"After a year at Princeton, I joined the Seismology Lab at Caltech. Team teaching with Dave Harkrider, looking at seismograms with Hiroo Kanamori, and trying to keep up with Don Anderson's triple puns have been most interesting, but working with talented graduate students has been the most rewarding.

"Thank you all for sending your best students to Caltech. Keep it up, and I promise to use the new broadband data to sharpen some of our crude images and perhaps, to image a plume all the way from the core-mantle-boundary to the surface (dream)."—*Don Helmberger, California Institute of Technology, Pasadena*

In Brief

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Now Voyager Deep in space, more than 20 years after its launch on September 5, 1977, and long after most people have forgotten about it, Voyager I will take over the mantle as the most distant human-made object in the solar system on February 15, according to the Jet Propulsion Laboratory (JPL). Somewhere beyond 10 billion km from Earth, the spacecraft finally will outdistance Pioneer 10.

Voyager I, racing through the solar system at 17.4 km/s, is expected to reach another milestone in about the year 2003, when it passes through the "termination shock" on its way to the heliopause. That invisible boundary separates our solar system from interstellar space and marks the outermost edge of the Sun's magnetic field.

Located just before the heliosphere, the termination shock is where the solar wind—a steady flow of electrically charged particles emitted by the Sun that expands supersonically into space—abruptly slows down from supersonic to subsonic speed.

Although Voyager I, and its slightly older but slower-moving sibling Voyager II—which was launched on August 20, 1977—have completed their primary mission of exploring the four large outer planets in the solar system, the instruments onboard the spacecraft continue to collect significant science data about the termination shock and other aspects of the solar system as part of the Voyager Interstellar Mission. The Voyagers transmit the data by a radio signal that takes 9 hrs traveling at the speed of light to reach Earth.

"The low-energy charged particle instruments on the two spacecraft continue to detect ions and electrons accelerated at the Sun and at huge shock waves, tens of [astronomical units] in radius, that are driven outward through the solar wind," says Stamatios Krimigis, principal investigator for the low energy charged particle subsystem at The Johns Hopkins University Applied Physics Laboratory. "During the past 5 years, we have observed marked variations in this ion population, but have yet to see clear evidence of the termination shock."

Four other science instruments are still functioning as part of the Voyager Interstellar Mission. The plasma subsystem, which measures protons in the solar wind, observed a slow, year-long increase in the speed of the solar wind that peaked in late 1996, and now is observing a slow decrease in solar wind velocity, according to John Richardson, principal investigator on the plasma subsystem at the Massachusetts Institute of Technology.

The magnetometer instruments onboard the Voyagers, which measure the magnetic fields carried out into interplanetary space by the solar wind, recently have been measuring the weakest interplanetary magnetic fields ever detected, according to Norman Ness, principal investigator for the magnetometer subsystem at the Bartol Research Institute at the University of Delaware.

The other science instruments still collecting data include the planetary radio astronomy subsystem and the ultraviolet spectrometer subsystem.

Science instruments onboard both Voyagers have enough electrical power to continue operating until about 2020. For further information, view the JPL Web site: vraptor.jpl.nasa.gov/voyager/voyager.html.

Head for the Hill About 250 scientists made 200 congressional visits during the 2nd annual Science and Technology Congressional Visits Day in Washington, D.C., last year.

This year, organizers are hoping for an even bigger turnout for the Capitol Hill event that marks one time of the year when Congress feels that there is a science constituency, says David Applegate, director of governmental affairs for the American Geological Institute (AGI).

The event, which actually spans two days, takes place this year on February 25–26. The first day includes briefings by Congressional leaders and staff.